

CLAIMS

What is claimed is:

1. A method of providing end office wireline telephony services to wireless telephony subscribers using a packet data network, said method comprising the steps
5 of:
 - (a) mapping a subscriber's wireless telephony protocol to a packet data network protocol;
 - (b) managing said subscriber's wireless mobility services for a wireless call; and

10 (c) mapping the packet data network protocol information pertaining to said wireless call to an end office access protocol,
such that the wireless call can utilize all of the wireline services associated with an end office telephony switching network.

15 2. The method of claim 1 wherein said mobility services include call origination, said call origination managing comprising the steps of:
 - (a) mapping a wireless base station controller protocol to a call control protocol utilized by said packet data network;
 - (b) sending call origination messages to a control node on said packet data network;
 - (c) sending the call origination messages to a gateway device providing access to a an end office telephony switch;
 - (d) mapping the call control protocol of the packet data network to the end office access protocol;
 - 25 (e) originating a call using the end office access protocol; and

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Sy *pp* *Cm* (f) routing the call from the end office telephony switch to its destination.

3. The method of claim 2 further comprising the steps of:
 - (a) establishing a virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch; and
 - (b) transmitting packetized speech data in both directions on the packet data network between the wireless subscriber and the end office telephony switch.
4. The method of claim 3 further comprising the step of de-allocating the virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch.
5. The method of claim 1 wherein said mobility services include call termination, said call termination managing comprising the steps of:
 - (a) mapping termination messages from an end office access protocol to a call control protocol of the packet data network;
 - (b) sending the termination messages to a control node on the packet data network;
 - (c) determining a serving wireless base station controller;
 - (d) sending the call termination messages to the serving wireless base station controller;
 - (e) mapping the call control protocol of the packet data network to wireless control protocol of the base station controller; and
 - (f) routing the call from the wireless base station controller to its destination.
6. The method of claim 5 further comprising the steps of:

- (a) establishing a virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch; and
- (b) transmitting packetized speech data in both directions on the packet data network between the wireless subscriber and the end office telephony switch.

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7. The method of claim 5 further comprising the step of de-allocating the virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch.
- 10 8. The method of claim 1 wherein said mobility services include call delivery, said call delivery managing comprising the steps of:
- (a) mapping termination messages from the access control protocol used by an end office telephony switch to a call control protocol used by the packet data network;
- (b) sending the termination messages to a control node on the data network;
- 15 (c) determining a serving wireless base station controller;
- (d) sending a routing request message to the serving switch if the serving base station controller is not on the packet data network;
- (e) providing a directory number to be used to deliver the call to the serving switch through the public switching telephone network (PSTN);
- 20 (f) formulating, in the call control node of the packet data network, a re-directing call control message to the gateway associated with the end office telephony switch that initiated the termination;
- (g) formulating, in the gateway associated with the end office telephony switch that initiated the termination, a re-directing call control message using the end office access control protocol; and

(h) re-directing the call through the public switching telephone network (PSTN) using the directory number supplied by the gateway.

9. The method of claim 1 wherein said mobility services include inter-system
5 handoff of a call from a current cell area having a base station controller gateway with
an established media channel to a target cell area, said inter-system handoff managing
comprising the steps of:

(a) maintaining a timer that will allow sufficient time for a mobile subscriber to
tune from the current cell area to the target cell area;

10 (b) constructing and sending a facilities directive message to a target mobile
switching center gateway;

(c) establishing a media channel with the target mobile switching center
gateway; and

15 (d) simulcasting all speech to the current base station controller gateway media
channel and the target mobile switching center gateway media channel until the timer
expires, upon which the current base station controller gateway media channel will
cease transmitting and receiving such that only the target mobile switching center
gateway media channel is transmitting and receiving.

20 10. The method of claim 1 wherein said mobility services includes inter-system
handoff of a call from a current cell area to a target cell area, said inter-system handoff
managing comprising the steps of:

(a) mapping a pilot strength measurement message into an A-interface protocol
handoff indication message;

25 (b) mapping the handoff indication message from the A-interface protocol of

the base station controller to a call control protocol utilized on the packet data network;

- (c) determining the location of a base station controller which serves the target cell area;
- (d) establishing a connection between a control node on the packet data network and a gateway node that supports trunking capabilities to an end office wireless switch serving the target cell area;
- 5 (e) sending a facilities directive message from the control node on the packet data network to the target end office wireless switch informing the switch of the handoff;
- 10 (f) establishing a call from the target end office wireless switch to the cell serving a mobile subscriber;
- (g) sending a connect message to the gateway serving the base station controller that initiated the inter-system handoff;
- 15 (h) sending a handoff complete message to the mobile subscriber's base station controller using the A-interface protocol;
- (i) establishing a virtual conference in the control node of the packet data network between the initial call and the connection established in step (d);
- (j) commencing a timer in the control node of the packet data network for a duration that will ensure the mobile subscriber is tuned to the target cell for RF
- 20 transmissions; and
- (k) terminating speech transmission to the original gateway node upon expiration of the timer in the control node of the packet data network.

11. The method of claim 1 wherein said mobility services includes intra-network handoff of a call from a current cell area having a base station controller gateway with

an established media channel to a target cell area having a base station controller gateway, said intra-network handoff managing comprising the steps of:

- (a) establishing a media channel with the target base station controller gateway; and
- 5 (b) simulcasting all speech to the current base station controller gateway media channel and the target base station controller gateway media channel;
- (c) signaling that the intra-network handoff is complete; and
- (d) ceasing transmitting and receiving on the current base station controller gateway media channel such that only the target base station controller gateway media
- 10 channel is transmitting and receiving.

12. The method of claim 1 wherein said mobility services includes intra-network handoff of a call from a current cell area to a target cell area, said intra-network handoff managing comprising the steps of:

- 15 (a) mapping a pilot strength measurement message into an A-interface protocol handoff indication message;
- (b) mapping the handoff indication message from the A-interface protocol of the base station controller to a call control protocol utilized on the packet data network;
- (c) determining the location of a base station controller which serves the target cell area;
- 20 (d) establishing a connection between a control node on the packet data network and a gateway node serving the base station controller of the target cell area;
- (e) establishing a virtual conference in the control node of the packet data network between the initial call and the connection established in step (d);
- 25 (f) sending a handoff initiated response message from the original base station

controller gateway upon establishment of the virtual conference;

(g) receiving a handoff completion message from the mobile in the target base station controller using the A-interface protocol; and
(h) terminating speech transmission to the original gateway node.

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13. A method of providing wireline telephony services to packet data network protocol telephony subscribers, said method comprising the steps of:

(a) managing said subscriber's wireless mobility services for a packet data network call; and
10 (b) mapping the packet data network protocol information pertaining to said packet data network call to an end office access protocol,
such that the packet data network call can utilize all of the wireline services associated with an end office switching network.

15 14. The method of claim 13 wherein said mobility services includes call origination, said call origination managing comprising the steps of:

(a) mapping a wireless base station controller protocol to a call control protocol utilized by said packet data network;
10 (b) sending call origination messages to a control node on said packet data network;
(c) sending the call origination messages to a gateway device providing access to an end office telephony switch;
15 (d) mapping the call control protocol of the packet data network to the end office access protocol;
20 (e) originating a call using the end office access protocol; and
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- (f) routing the call from the end office telephony switch to its destination.
15. The method of claim 14 further comprising the steps of:
- 5 (a) establishing a virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch; and
- (b) transmitting packetized speech data in both directions on the packet data network between the wireless subscriber and the end office telephony switch.
16. The method of claim 15 further comprising the step of de-allocating the virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch.
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17. The method of claim 13 wherein said mobility services includes call termination, said call termination managing comprising the steps of:
- 15 (a) mapping termination messages from an end office access protocol to a call control protocol of the packet data network;
- (b) sending the termination messages to a control node on the packet data network;
- (c) determining a serving wireless base station controller;
- 20 (d) sending the call termination messages to the serving wireless base station controller;
- (e) mapping the call control protocol of the packet data network to wireless control protocol of the base station controller; and
- (f) routing the call from the wireless base station controller to its destination.

18. The method of claim 17 further comprising the steps of:
- (a) establishing a virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch; and
 - (b) transmitting packetized speech data in both directions on the packet data network between the wireless subscriber and the end office telephony switch.
19. The method of claim 17 further comprising the step of de-allocating the virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch.
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20. The method of claim 13 wherein said mobility services includes call delivery, said call delivery managing comprising the steps of:
- (a) mapping termination messages from the access control protocol used by an end office telephony switch to a call control protocol used by the packet data network;
 - (b) sending the termination messages to a control node on the data network;
 - (c) determining a serving wireless base station controller;
 - (d) sending a routing request message to the serving switch if the serving base station controller is not on the packet data network;
 - (e) providing a directory number to be used to deliver the call to the serving switch through the public switching telephone network (PSTN);
 - (f) formulating, in the call control node of the packet data network, a re-directing call control message to the gateway associated with the end office telephony switch that initiated the termination;
 - (g) formulating, in the gateway associated with the end office telephony switch that initiated the termination, a re-directing call control message using the

access control protocol; and

(h) re-directing the call through the public switching telephone network (PSTN) using the directory number supplied by the gateway.

5 21. A system for providing end office wireline telephony services to wireless telephony subscribers using a packet data network, said system comprising:

means for mapping a subscriber's wireless telephony protocol to a packet data network protocol;

means for managing said subscriber's wireless mobility services for a wireless call; and

means for mapping the packet data network protocol information pertaining to said wireless call to an end office access protocol,

such that the wireless call can utilize all of the wireline services associated with an end office telephony switching network.

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22. The system of claim 21 wherein said mobility services include call origination, said call origination managing comprising:

means for mapping a wireless base station controller protocol to a call control protocol utilized by said packet data network;

20 means for sending call origination messages to a control node on said packet data network;

means for sending the call origination messages to a gateway device providing access to an end office telephony switch;

means for mapping the call control protocol of the packet data network to the end office access protocol;

means for originating a call using the end office access protocol; and
means for routing the call from the end office telephony switch to its
destination.

- 5 23. The system of claim 22 further comprising:
 means for establishing a virtual speech path on the packet data network
 between the wireless subscriber and the end office telephony switch; and
 means for transmitting packetized speech data in both directions on the packet
 data network between the wireless subscriber and the end office telephony switch.
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- 15 24. The system of claim 23 further comprising means for de-allocating the virtual
 speech path on the packet data network between the wireless subscriber and the end
 office telephony switch.
- 20 25. The system of claim 21 wherein said mobility services include call
 termination, said call termination managing comprising:
 means for mapping termination messages from an end office access protocol to
 a call control protocol of the packet data network;
 means for sending the termination messages to a control node on the packet
 data network;
 means for determining a serving wireless base station controller;
 means for sending the call termination messages to the serving wireless base
 station controller;
 means for mapping the call control protocol of the packet data network to
25 wireless control protocol of the base station controller; and

means for routing the call from the wireless base station controller to its destination.

26. The system of claim 25 further comprising:

5 means for establishing a virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch; and
means for transmitting packetized speech data in both directions on the packet data network between the wireless subscriber and the end office telephony switch.

10 27. The system of claim 25 further comprising means for de-allocating the virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch.

15 28. The system of claim 21 wherein said mobility services include call delivery, said call delivery managing comprising:

means for mapping termination messages from the access control protocol used by an end office telephony switch to a call control protocol used by the packet data network;

20 means for sending the termination messages to a control node on the data network;

means for determining a serving wireless base station controller;

means for sending a routing request message to the serving switch if the serving base station controller is not on the packet data network;

25 means for providing a directory number to be used to deliver the call to the serving switch through the public switching telephone network (PSTN);

means for formulating, in the call control node of the packet data network, a re-directing call control message to the gateway associated with the end office telephony switch that initiated the termination;

means for formulating, in the gateway associated with the end office
5 telephony switch that initiated the termination, a re-directing call control message
using the end office access control protocol; and

means for re-directing the call through the public switching telephone network
(PSTN) using the directory number supplied by the gateway.

10 29. The system of claim 21 wherein said mobility services include inter-system
handoff of a call from a current cell area having a base station controller gateway with
an established media channel to a target cell area, said inter-system handoff managing
comprising the steps of:

means for maintaining a timer that will allow sufficient time for a mobile
15 subscriber to tune from the current cell area to the target cell area;

means for constructing and sending a facilities directive message to a target
mobile switching center gateway;

means for establishing a media channel with the target mobile switching center
gateway; and

20 means for simulcasting all speech to the current base station controller gateway
media channel and the target mobile switching center gateway media channel until the
timer expires, upon which the current base station controller gateway media channel
will cease transmitting and receiving such that only the target mobile switching center
gateway media channel is transmitting and receiving.

30. The system of claim 21 wherein said mobility services includes inter-system handoff of a call from a current cell area to a target cell area, said inter-system handoff managing comprising:

- means for mapping a pilot strength measurement message into an A-interface protocol handoff indication message;
- means for mapping the handoff indication message from the A-interface protocol of the base station controller to a call control protocol utilized on the packet data network;
- means for determining the location of a base station controller which serves the target cell area;
- means for establishing a connection between a control node on the packet data network and a gateway node that supports trunking capabilities to an end office wireless switch serving the target cell area;
- means for sending a facilities directive message from the control node on the packet data network to the target end office wireless switch informing the switch of the handoff;
- means for establishing a call from the target end office wireless switch to the cell serving a mobile subscriber;
- means for sending a connect message to the gateway serving the base station controller that initiated the inter-system handoff;
- means for sending a handoff complete message to the mobile subscriber's base station controller using the A-interface protocol;
- means for establishing a virtual conference in the control node of the packet data network between the initial call and the connection established between the control node and gateway node;

means for commencing a timer in the control node of the packet data network for a duration that will ensure the mobile subscriber is tuned to the target cell for RF transmissions; and

- means for terminating speech transmission to the original gateway node upon
5 expiration of the timer in the control node of the packet data network.

31. The system of claim 21 wherein said mobility services includes intra-network handoff of a call from a current cell area having a base station controller gateway with an established media channel to a target cell area having a base station controller 10 gateway, said intra-network handoff managing comprising the steps of:

means for establishing a media channel with the target base station controller gateway; and

means for simulcasting all speech to the current base station controller gateway media channel and the target base station controller gateway media channel;

15 means for signaling that the intra-network handoff is complete; and

means for ceasing transmitting and receiving on the current base station controller gateway media channel such that only the target base station controller gateway media channel is transmitting and receiving.

20 32. The system of claim 21 wherein said mobility services includes intra-network handoff of a call from a current cell area to a target cell area, said intra-network handoff managing comprising:

means for mapping a pilot strength measurement message into an A-interface protocol handoff indication message;

25 means for mapping the handoff indication message from the A-interface

protocol of the base station controller to a call control protocol utilized on the packet data network;

means for determining the location of a base station controller which serves the target cell area;

5 means for establishing a connection between a control node on the packet data network and a gateway node serving the base station controller of the target cell area;

means for establishing a virtual conference in the control node of the packet data network between the initial call and the connection established between the control node and gateway node;

10 means for sending a handoff initiated response message from the original base station controller gateway upon establishment of the virtual conference;

means for receiving a handoff completion message from the mobile in the target base station controller using the A-interface protocol; and

means for terminating speech transmission to the original gateway node.

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33. A computer program product for providing end office wireline telephony services to wireless telephony subscribers using a packet data network, the computer program product having a medium with a computer program embodied thereon, the computer program product comprising:

20 computer program code for mapping a subscriber's wireless telephony protocol to a packet data network protocol;

computer program code for managing said subscriber's wireless mobility services for a wireless call; and

computer program code for mapping the packet data network protocol
25 information pertaining to said wireless call to an end office access protocol,

such that the wireless call can utilize all of the wireline services associated with an end office telephony switching network.

34. The computer program product of claim 33 wherein said mobility services
5 include call origination, said call origination managing comprising:

computer program code for mapping a wireless base station controller protocol
to a call control protocol utilized by said packet data network;

computer program code for sending call origination messages to a control node
on said packet data network;

- 10 computer program code for sending the call origination messages to a gateway
device providing access to an end office telephony switch;

computer program code for mapping the call control protocol of the packet
data network to the end office access protocol;

- computer program code for originating a call using the end office access
15 protocol; and

computer program code for routing the call from the end office telephony
switch to its destination.

35. The computer program product of claim 34 further comprising:

- 20 computer program code for establishing a virtual speech path on the packet
data network between the wireless subscriber and the end office telephony switch; and
computer program code for transmitting packetized speech data in both
directions on the packet data network between the wireless subscriber and the end
office telephony switch.

36. The computer program product of claim 35 further comprising computer program code for de-allocating the virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch.

5 37. The computer program product of claim 33 wherein said mobility services include call termination, said call termination managing comprising:

computer program code for mapping termination messages from an end office access protocol to a call control protocol of the packet data network;

10 computer program code for sending the termination messages to a control node on the packet data network;

computer program code for determining a serving wireless base station controller;

computer program code for sending the call termination messages to the serving wireless base station controller;

15 computer program code for mapping the call control protocol of the packet data network to wireless control protocol of the base station controller; and

computer program code for routing the call from the wireless base station controller to its destination.

20 38. The computer program product of claim 37 further comprising:

computer program code for establishing a virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch; and

computer program code for transmitting packetized speech data in both directions on the packet data network between the wireless subscriber and the end office telephony switch.

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39. The computer program product of claim 37 further comprising computer program code for de-allocating the virtual speech path on the packet data network between the wireless subscriber and the end office telephony switch.

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40. The computer program product of claim 33 wherein said mobility services include call delivery, said call delivery managing comprising:

computer program code for mapping termination messages from the access control protocol used by an end office telephony switch to a call control protocol used
10 by the packet data network;

computer program code for sending the termination messages to a control node on the data network;

computer program code for determining a serving wireless base station controller;

15 computer program code for sending a routing request message to the serving switch if the serving base station controller is not on the packet data network;

computer program code for providing a directory number to be used to deliver the call to the serving switch through the public switching telephone network (PSTN);

computer program code for formulating, in the call control node of the packet
20 data network, a re-directing call control message to the gateway associated with the end office telephony switch that initiated the termination;

computer program code for formulating, in the gateway associated with the end office telephony switch that initiated the termination, a re-directing call control message using the access control protocol; and

25 computer program code for re-directing the call through the public switching

telephone network (PSTN) using the directory number supplied by the gateway.

41. The computer program product of claim 33 wherein said mobility services include inter-system handoff of a call from a current cell area having a base station controller gateway with an established media channel to a target cell area, said inter-system handoff managing comprising the steps of:

computer program code for maintaining a timer that will allow sufficient time for a mobile subscriber to tune from the current cell area to the target cell area;

- 10 computer program code for constructing and sending a facilities directive message to a target mobile switching center gateway;

computer program code for establishing a media channel with the target mobile switching center gateway; and

- 15 computer program code for simulcasting all speech to the current base station controller gateway media channel and the target mobile switching center gateway media channel until the timer expires, upon which the current base station controller gateway media channel will cease transmitting and receiving such that only the target mobile switching center gateway media channel is transmitting and receiving.

42. The computer program product of claim 33 wherein said mobility services includes inter-system handoff of a call from a current cell area to a target cell area, said inter-system handoff managing comprising:

computer program code for mapping a pilot strength measurement message into an A-interface protocol handoff indication message;

- 25 computer program code for mapping the handoff indication message from the A-interface protocol of the base station controller to a call control protocol utilized on

the packet data network;

computer program code for determining the location of a base station controller which serves the target cell area;

computer program code for establishing a connection between a control node

- 5 on the packet data network and a gateway node that supports trunking capabilities to an end office wireless switch serving the target cell area;

computer program code for sending a facilities directive message from the control node on the packet data network to the target end office wireless switch informing the switch of the handoff;

- 10 computer program code for establishing a call from the target end office wireless switch to the cell serving a mobile subscriber;

computer program code for sending a connect message to the gateway serving the base station controller that initiated the inter-system handoff;

- 15 computer program code for sending a handoff complete message to the mobile subscriber's base station controller using the A-interface protocol;

computer program code for establishing a virtual conference in the control node of the packet data network between the initial call and the connection established between the control node and gateway node;

- 20 computer program code for commencing a timer in the control node of the packet data network for a duration that will ensure the mobile subscriber is tuned to the target cell for RF transmissions; and

computer program code for terminating speech transmission to the original gateway node upon expiration of the timer in the control node of the packet data network.

43. The computer program product of claim 33 wherein said mobility services includes intra-network handoff of a call from a current cell area having a base station controller gateway with an established media channel to a target cell area having a base station controller gateway, said intra-network handoff managing comprising the
5 steps of:

computer program code for establishing a media channel with the target base station controller gateway; and

10 computer program code for simulcasting all speech to the current base station controller gateway media channel and the target base station controller gateway media channel;

computer program code for signaling that the intra-network handoff is complete; and

15 computer program code for ceasing transmitting and receiving on the current base station controller gateway media channel such that only the target base station controller gateway media channel is transmitting and receiving.

44. The computer program product of claim 33 wherein said mobility services includes intra-network handoff of a call from a current cell area to a target cell area, said intra-network handoff managing comprising:

20 computer program code for mapping a pilot strength measurement message into an A-interface protocol handoff indication message;

computer program code for mapping the handoff indication message from the A-interface protocol of the base station controller to a call control protocol utilized on the packet data network;

25 computer program code for determining the location of a base station

controller which serves the target cell area;

computer program code for establishing a connection between a control node on the packet data network and a gateway node serving the base station controller of the target cell area;

5 computer program code for establishing a virtual conference in the control node of the packet data network between the initial call and the connection established between the control node and gateway node;

computer program code for sending a handoff initiated response message from the original base station controller gateway upon establishment of the virtual
10 conference;

computer program code for receiving a handoff completion message from the mobile in the target base station controller using the A-interface protocol; and

computer program code for terminating speech transmission to the original gateway node.

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45. A system for providing wireline telephony services to wireless subscribers utilizing a packet data network, said system comprising:

a base station controller for providing wireline services to wireless subscribers,
said base station controller further providing protocol mapping between a wireless
20 protocol and a packet data network protocol;

a mobility gatekeeper for managing wireless mobility services for each wireless call including the establishment of a call control path and a speech path between said base station controller and a serving end office point; and

an end office gateway for providing protocol conversion between the packet
25 data network protocol and the end office access protocol, wherein a wireless subscriber

has access to all wireline services provided by said end office point.

46. The system of claim 45 wherein said packet data network is an internet protocol (*IP*) network.

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47. The system of claim 45 wherein said packet data network is an asynchronous transfer mode (ATM) network.

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48. The system of claim 45 wherein said wireless protocol is an *IS-634* protocol.

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49. The system of claim 45 wherein said packet data network protocol uses the *H.323* protocol.

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50. The system of claim 45 wherein said packet data network protocol uses the Session Initiation Protocol (*SIP*).

51. The system of claim 45 wherein said packet data network protocol uses the Multi-Gateway Control Protocol (*MGCP*).